DETAILED ACTION

Remarks

1. In response to communications filed on August 21, 2006, claims 1-30 are presented for examination.

Information Disclosure Statement

2. The information disclosure statement filed April 11, 2008 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered. In particular, the first page (page 348) is missing of the document entitled "A Quick Search Method For Audio And Video Signals Based On Histogram Pruning" by Kunio Kashino et al. from September 2003. This is in spite of the fact that the information disclosure statement says that this page is present. The examiner has also indicated on the information disclosure statement that there is no English translation of the foreign documents.

Specification

3. The disclosure is objected to because of the following informalities: in line 13, page 10 "and means, variances, other derivatives thereof" appears to be a grammatical mistake for --and means, variances, **and** other derivatives thereof--. Appropriate correction is required.

Claim Objections

4. Claim 7 is objected to because of the following informaliy: in line 1, claim 7, “if there are more than one segment**s**” should be --if there are more than one segment--. Appropriate correction is required.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cunningham (US 2002/0129038) in view of Attias (US 2004/0002935) and Cereghini et al. (Cereghini) (US 6,496,834).

a. Referring to claim 1:

i. Cunningham teaches a method for searching a database for a target clip (computer implemented data mining using Gaussian Mixture models for data accessed from a database in lines 1-6, Abstract) in a multiprocessor system (for relational distributed data mining using parallelism mechanisms in Figure 1, paragraph [0006], page 1 and lines 6-10, paragraph [0032], page 2), comprising:

1st. partitioning said database into a plurality of groups (clustering algorithms that partition the data set of a large database into several disjoint groups in lines 3 and 4, paragraph [0015], page 1 and paragraph [0016], page 1);

2nd. establishing a model for said target clip (creating the Gaussian Mixture Model for the accessed data in lines 2-6, paragraph [0017], page 1); and

3rd. processing said scheduled groups in parallel by said plurality of processors to search for said target clip (performing operations by the data servers 110 that use partitioning methods with parallelism mechanisms against the relational database in a parallel manner in lines 6-11, paragraph [0032], page 2).

ii. Cunningham does not teach that the database is an audio database and the target clip is an audio clip.

iii. On the other hand, Attias teaches that the database is an audio database and the target clip is an audio clip (databases that are multimedia databases having video or audio clips in paragraph [0005], page 1).

iv. Cunningham at least suggests dynamically scheduling said plurality of groups to a plurality of processors in said multiprocessor system (scheduling and prioritizing the SQL statements received from the OLAP Client 114 and performing the SQL statements against a Data Mining View 128 to retrieve the data from the database in lines 1-8, paragraph [0030], page 2 and paragraph [0031], page 2); and

v. Moreover, Cereghini teaches dynamically scheduling said plurality of groups (launching several UPDATE statements in parallel and executing queries in parallel in lines 6-8, column 11 and lines 5 and 6, column 12) to a plurality of processors in said multiprocessor system (in a massively parallel processing environment or MPP computer system 200 comprised of one or more nodes 202, each of the nodes 202 comprised of one or more processors in Figure 2 and lines 46-52, column 4).

vi. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to have enhanced the clustering algorithms that create Gaussian Mixture models in Cunningham with the multimedia databases containing audio clips of Attias and with the executing of queries in parallel in the massively parallel processing environment of Cereghini.

vii. A person of ordinary skill in the art would have been motivated to combine the clustering algorithms of Cunningham with the multimedia databases of Attias and the executing of queries in parallel of Cereghini because Cunningham, Attias and Cereghini all deal with clustering data in databases in the process of searching (i.e., data mining) in multiprocessor systems including the use of Gaussian Mixture models and the ability to use parallel data retrieval for a database does not depend on the type of data in the database.

b. Referring to claim 2:

i. Cunningham, Attias and Cereghini combine to teach all the limitations of claim 1.

ii. Cunningham and Attias do not teach *the method of searching an audio database for a target audio clip in a multiprocessor system*, wherein partitioning said audio database comprises determining a size for each of said plurality of groups, said size being determined to reduce the amount of overlapped computation among said plurality of groups and load imbalance in parallel processing of said plurality of groups.

iii. On the other hand, Cereghini teaches wherein partitioning said audio database comprises determining a size for each of said plurality of groups, said size being determined to reduce the amount of overlapped computation among said plurality of groups and load imbalance in parallel processing of said plurality of groups (executing queries in parallel, speeding-up the

process by making data block size smaller to get a finer grain for parallelism and a better balance load among processors in lines 59-63, column 12).

iv. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to have enhanced the clustering algorithms that create Gaussian Mixture models in Cunningham with the multimedia databases containing audio clips of Attias and with the executing of queries in parallel and data block sizes in the massively parallel processing environment of Cereghini.

v. A person of ordinary skill in the art would have been motivated to combine the clustering algorithms of Cunningham with the multimedia databases of Attias and the executing of queries in parallel and data block sizes of Cereghini because Cunningham, Attias and Cereghini all deal with clustering data in databases in the process of searching (i.e., data mining) in multiprocessor systems including the use of Gaussian Mixture models and the ability to use parallel data retrieval for a database does not depend on the type of data in the database.

c. Referring to claim 3: Cunningham teaches *the method of searching an audio database for a target audio clip in a multiprocessor system*, wherein establishing a model for said target audio clip comprises extracting a feature vector sequence from said target audio clip and modeling said feature vector sequence (the Expectation-Maximization or EM algorithm generalizing the probability density function to get the multivariate normal density for a p-dimensional vector in paragraph [0036], page 2 and paragraph [0038], page 3) based on a Gaussian Mixture model ("GMM") (the EM algorithm performed to create the Gaussian Mixture Model for the accessed data in lines 2-6, paragraph [0017], page 1), said GMM including a

plurality of Gaussian components (fitted by a linear combination of Gaussian or normal distributions in paragraph [0036], page 2).

d. Referring to claim 4: Cunningham teaches *the method of searching an audio database for a target audio clip in a multiprocessor system (3) with extraction and modeling of a feature vector sequence*, wherein modeling said feature vector sequence comprises estimating mixture weights for each of said plurality of Gaussian components (the likelihood that the mixture of multivariate normal distributions for p-dimensional vectors is given by the formula $p(x) = \sum w_i\, p(x,i)$ where $p(x,i)$ is the normal probability density function for each cluster and w_i is the weight that cluster represents from the entire database in paragraph [0038], pages 2 and 3, paragraph [0042], page 3 and lines 1-3, paragraph [0043], page 3) (See also lines 9-12, paragraph [0047], page 3).

e. Referring to claim 5:

i. Cunningham, Attias and Cereghini combine to teach all the limitations of claim 1.

ii. Cunningham at least suggests *the method of searching an audio database for a target audio clip in a multiprocessor system*, wherein processing said scheduled groups in parallel comprises:

1st. partitioning each of said scheduled groups into at least one segment (distinguishing segments in the accessed data in claim 13, page 8) (See also paragraphs [0097]-[0100], page 5); and

2nd. for each segment,

(01) extracting a feature vector sequence for the segment (each cluster having its corresponding vector in lines 3-6, paragraph [0043], page 3), and

(02) modeling said feature vector sequence (the Expectation-Maximization or EM algorithm generalizing the probability density function to get the multivariate normal density for a p-dimensional vector in paragraph [0036], page 2 and paragraph [0038], page 3) based on a Gaussian Mixture model ("GMM") (the EM algorithm performed to create the Gaussian Mixture Model for the accessed data in lines 2-6, paragraph [0017], page 1), said GMM including a plurality of Gaussian components (fitted by a linear combination of Gaussian or normal distributions in paragraph [0036], page 2).

iii. Furthermore, Attias teaches wherein processing said scheduled groups in parallel comprises:

1st. partitioning each of said scheduled groups into at least one segment (generating segment profiles of at least one segment of each file being searched, the files clustered based, at least in part, upon vector quantization of the extracted features in Figures 5 and 6, lines 6 and 7, paragraph [0067], page 4 and lines 1-4, paragraph [0068], page 5); and (If a segment belongs to a file of a cluster, then the segment also belongs to the cluster.)

2nd. for each segment,

(01) extracting a feature vector sequence for the segment (extracting features from subband signals which are extracted from segments of files in Figure 5, lines 3-6, paragraph [0065], page 4), and

(02) modeling said feature vector sequence based on a Gaussian Mixture model ("GMM"), said GMM including a plurality of Gaussian components (fitting a Gaussian mixture model to the extracted subband signals for each frame based, at least in part, upon responsibility of mixture components of the mixture model in paragraph [0066], pages 4 and 5).

iv. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to have enhanced the clustering algorithms that create Gaussian Mixture models in Cunningham with the multimedia databases containing audio clips and generated segments of Attias and with the executing of queries in parallel in the massively parallel processing environment of Cereghini.

v. A person of ordinary skill in the art would have been motivated to combine the clustering algorithms of Cunningham with the multimedia databases and generated segments of Attias and the executing of queries in parallel of Cereghini because Cunningham, Attias and Cereghini all deal with clustering data in databases in the process of searching (i.e., data mining) in multiprocessor systems including the use of Gaussian Mixture models and the ability to use parallel data retrieval for a database does not depend on the type of data in the database.

f. Referring to claim 6:

i. Cunningham, Attias and Cereghini combine to teach all the limitations of claim 5.

ii. Cunningham and Cereghini do not teach *the method of searching an audio database for a target audio clip in a multiprocessor system (5) with feature vector sequences extracted and modeled for segments of scheduled groups*, wherein each of said at least one segment has the same length in time as that of said target audio clip.

iii. On the other hand, Attias teaches wherein each of said at least one segment has the same length in time as that of said target audio clip (the query segment can be, for example, a segment of audio such as a song or particular voice that a user desires to find within the multi-media files in lines 2-5, paragraph [0046], page 3).

(The query segment and the segment of audio ... that a user desires of Attias correspond to the target audio clip of the application and the at least one segment. Since the query segment and the segment of audio ... that a user desires are the same, they must have the same length.)

iv. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to have enhanced the clustering algorithms that create Gaussian Mixture models in Cunningham with the multimedia databases containing audio clips of Attias and with the executing of queries in parallel in the massively parallel processing environment of Cereghini.

v. A person of ordinary skill in the art would have been motivated to combine the clustering algorithms of Cunningham with the multimedia databases of Attias and the executing of queries in parallel of Cereghini because Cunningham, Attias and Cereghini all deal with clustering data in databases in the process of searching (i.e., data mining) in multiprocessor systems including the use of Gaussian Mixture models and the ability to use parallel data retrieval for a database does not depend on the type of data in the database.

g. Referring to claim 7: Cunningham teaches *the method of searching an audio database for a target audio clip in a multiprocessor system (5) with feature vector sequences extracted and modeled for segments of scheduled groups*, wherein if there are more than one segment in an audio stream, each segment partially overlaps with a segment that immediately precedes that segment (the segment profile for a segment is based on responsibility vectors of the frames of the segment from which subband signals are extracted which are obtained by applying an N-point window to frames of the files in lines 3-6 paragraph [0033], page 2, lines 3-8, paragraph [0064], page 4 and lines 1-4, paragraph [0068], page 5).

(The concept of using a window to extract subband signals from frames within segments means some of the frames in one segment in the window will be the same as some of the frames in the next segment from which subband signals are extracted. Such a window would advance one frame at a time as it extracts subband signals for segments.)

h. Referring to claim 8: Cunningham teaches *the method of searching an audio database for a target audio clip in a multiprocessor system (5) with feature vector sequences extracted and modeled for segments of scheduled groups*, wherein said plurality of Gaussian components are common for different segments and said target audio clip (the mixture of multivariate normal distributions for p-dimensional vectors focuses on the case where each cluster has their corresponding vector and all of them have the same covariance matrix E in lines 1-3, paragraph [0042], page 3 and lines 3-6, paragraph [0043], page 3).

i. Referring to claim 9: Cunningham teaches *the method of searching an audio database for a target audio clip in a multiprocessor system (5) with feature vector sequences extracted and modeled for segments of scheduled groups (8) and common Gaussian components*, wherein modeling said feature vector sequence comprises estimating mixture weights for each of said plurality of Gaussian components (the likelihood that the mixture of multivariate normal distributions for p-dimensional vectors is given by the formula $p(x) = \sum w_i \, p(x,i)$ where $p(x,i)$ is the normal probability density function for each cluster and w_i is the weight that cluster represents from the entire database in paragraph [0038], pages 2 and 3, paragraph [0042], page 3 and lines 1-3, paragraph [0043], page 3) (See also lines 9-12, paragraph [0047], page 3).

j. Referring to claim 10:

i. Cunningham, Attias and Cereghini combine to teach all the limitations of claim 9.

ii. Cunningham and Cereghini do not teach *the method of searching an audio database for a target audio clip in a multiprocessor system (5) with feature vector sequences extracted and modeled for segments of scheduled groups (8) and common Gaussian components (9) with modeling by the mixture of multivariate normal distributions*, further comprising: for each segment,

1st. computing a Kullback-Leibler ("KL") distance between a GMM of said segment and a GMM of said target audio clip; and

2nd. determining that said segment matches said target audio clip, if said KL distance is smaller than a pre-determined threshold.

iii. However, Cunningham teaches for each segment, determining that said segment matches said target audio clip, if the log likelihood is smaller than a pre-determined threshold (executing the E step and the M step in the Expectation-Maximization or EM algorithm as long as the change in log-likelihood or llh is greater than ε in paragraph [0050], page 3) (See also Figure 2A and paragraphs [0051], [0055] and [0056], pages 3 and 4).

iv. On the other hand, Attias teaches for each segment (each of a plurality of generated segment profiles r_s of a segment in lines 4-8, paragraph [0045], page 3 and lines 1-3, paragraph [0055], page 4), computing a Kullback-Leibler ("KL") distance between a GMM of said segment and a GMM of said target audio clip (calculating a Kullback-Leibler or KL distance between the query profile q_s generated based on a query segment and the segment profile r_s in lines 4-8, paragraph [0045], page 3 and lines 1-3, paragraph [0055], page 4) (See also paragraphs [0053] and [0054], page 4); and

v. Moreover, Attias at least suggests for each segment (each of a plurality of generated segment profiles r_s of a segment in lines 4-8, paragraph [0045], page 3 and lines 1-3, paragraph [0055], page 4), determining that said segment matches said target audio clip, if said KL distance is smaller than a pre-determined threshold (providing information associated with a likelihood such as a probability, by implementing the KL distance, that a particular file includes the query segment based, at least in part, upon the query profile and a segment profile of a segment of the particular file in paragraphs [0053] and [0054], page 4).

vi. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to have enhanced the clustering algorithms that terminate using a tolerance that create Gaussian Mixture models in Cunningham with the multimedia databases containing audio clips and generated segments with the computation of Kullback-Leibler (KL) distance of Attias and with the executing of queries in parallel in the massively parallel processing environment of Cereghini.

vii. A person of ordinary skill in the art would have been motivated to combine the clustering algorithms with tolerance of Cunningham with the multimedia databases and generated segments and Kullback-Leibler (KL) distance of Attias and the executing of queries in parallel of Cereghini because Cunningham, Attias and Cereghini all deal with clustering data in databases in the process of searching (i.e., data mining) in multiprocessor systems including the use of Gaussian Mixture models and the ability to use parallel data retrieval for a database does not depend on the type of data in the database. Furthermore, the Kullback-Leibler (KL) distance of Attias is a likelihood similar to the log-likelihood of Cunningham which is compared to a tolerance.

k. Referring to claim 11: Cunningham teaches *the method of searching an audio database for a target audio clip in a multiprocessor system (5) with feature vector sequences extracted and modeled for segments of scheduled groups (8) and common Gaussian components (9) with modeling by the mixture of multivariate normal distributions using Kullback-Leibler distance*, further comprising skipping processing a number of segments if said KL distance is larger than a predetermined value, said number of segments dependent on the value of said KL distance (handle outliers using Mahalanobis distances instead of using the probability density function when the points do not adjust to a normal distribution cleanly, or when they are far from cluster means in Figure 2B and paragraphs [0087]-[0089], page 5).

(If points are handled using Mahalanobis distances instead of using the probability density function, then they are skipped for the probability density function. Attias shows that it would be obvious to do so also for segments.)

l. Referring to claim 12: Cunningham teaches *the method of searching an audio database for a target audio clip in a multiprocessor system*, wherein said multiprocessor system comprises a memory shared by said plurality of processors (data servers 110A-110E are coupled to the third server tier 106 that stores the databases in lines 6-10, paragraph [0028], page 2 and paragraph [0031], page 2).

m. Referring to claims 13-18: Claims 13 and 14 are directed to a similar scope as claims 1 and 2 respectively except for the limitations of a partitioning module, a scheduler and an audio search model. Cunningham teaches a partitioning module (a server 106 in Figure 1 and paragraph [0031], page 2) and an audio search model (the RDBMS 132 interfaced to the data servers 110A-110E in Figure 1 and lines 1-3, paragraph [0032], page 2) when combined with

Attias (databases that are multimedia databases having video or audio clips in paragraph [0005], page 1) and Cereghini teaches a scheduler (computer programs on the nodes 202 in Figure 1 and lines 56-67, column 4). Therefore, claims 13 and 14 are rejected with the same rationale applied against claims 1 and 2 respectively. Furthermore, claim 15 is directed to a scope within the scope of claims 5, 6 and 8 except for the limitations of a feature extractor and a modeling module. Attias teaches a feature extractor (a feature extractor 120 in Figure 1 and lines 3-6, paragraph [0031], page 2 and paragraph [0034], page 3) and a modeling module (a query component 210 in Figure 2 and paragraphs [0046] and [0047], page 3). Finally, claim 16 is directed to a scope within the scope of claims 5 and 8 and claims 17 and 18 are directed to a similar scope as claims 10 and 11 respectively. Therefore, claim 16 is rejected with the same rationale applied against claims 5 and 8 and claims 17 and 18 are rejected with the same rationale applied against claims 10 and 11 respectively.

n. Referring to claims 19-30: Claims 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 and 30 are directed to a similar scope as claims 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 respectively. Therefore, claims 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 and 30 are rejected with the same rationale applied against claims 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 respectively. Note that the methods discussed in claims 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 are implemented by the combination of the software environment of Cunningham (in Figure 1 and paragraph [0028], page 2), the computer components of Attias (in Figure 3 and paragraph [0057], page 4) and computer programs on the nodes 202 of Cereghini (in Figure 1 and lines 56-67, column 4) which correspond to the instructions that the articles of claims 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 and 30 respectively comprise.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a. Almasi et al. (US 6260036) discloses parallel retrieval from an audio database using Gaussian neighborhoods.

b. Campos et al. (US 20030212692) discloses clustering data in databases using Gaussian mixture models.

c. Chen et al. (US 6470331) discloses processing databases in parallel by partitioning the data.

d. Dhillon et al. (US 6269376) discloses clustering data in databases when using a distributed-memory multi-processor system.

e. Fayyad et al. (US 6581058) discloses a clustering algorithm for accessing data in databases using Gaussian mixture models and the Expectation-Maximization Algorithm.

f. Fujiwara et al. (US 6381601) discloses grouping of data in databases for the executing of queries in parallel.

g. Gotfried et al. (US 5765166) discloses parallel processing of databases by grouping data in a multiprocessing system.

h. Jardin (US 20040181523) discloses distributed processing for databases by distributing jobs or tasks of clustered data to execute on multiple nodes.

i. Kenner et al. (US 6181867) discloses searching a database for an audio-video clip in a multi-processing computer system in which the search takes place using a plurality of database index managers, each with their own storage and retrieval units.

j. Matsuzawa et al. (US 6182061) discloses performing a plurality of aggregations of database data in parallel.

k. Ro (US 5793444) discloses a storage system for audio and video signals with data transmission to a memory array in parallel.

l. Siegwart (US 6460035) discloses data clustering of data in databases using Gaussian mixture distributions with mixing fractions.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian E. Weinrich, Ph.D., whose telephone number is 571-270-3793. The examiner can normally be reached on Monday-Friday 9-5 ET.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tony Mahmoudi can be reached on 571-272-4078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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